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Correspondence.—Wishing to make this Journal a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of these subjects a pleasure or a profession.

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THE BOSTON MEETING.

The Ninth Annual Meeting of the American Gas Light Association was held at the Hotel Brunswick, Boston, Mass., on the 19th, 20th, and 21st days of October. When Boston had been named as the place for holding the meeting of 1881, it was predicted that the attendance of members would be greater than that of any other session in its history. This prophesy was more than borne out by the presence of over 125 active members of the Association.

The meeting was called to order on the morning of the 19th, with the President, Mr. Wm. H Price, of Cleveland, Ohio, in the Chair. Owing to the unavoidable absence of the Secretary, Captain W. Henry White, the Association selected Mr. Geo. B. Neal, Charlestown, Mass., to fill the office of Secretary, *pro tem.* The President's address, which will be found in another column, was listened to with interest and attention. He gave some consideration to the claims of the electric light, and spoke with great earnestness of the necessity of employing every known means of improving the methods of manufacture by the use of labor-saving appliances and improved machinery. He also spoke of the near approach of the time when the gas maker of this country would realize great benefits from the returns from his residual products.

The first paper read was one presented by Dr. T. O'Connor Sloane, of New York, on the subject of "Gas Stoves for Heating Apartments." The subject was treated in a clear and logical manner. On the afternoon of the first day papers were presented by Messrs. C. J. R. Humphreys, of Bergen Point, New Jersey, and Malcolm S. Greenough, of Boston, Mass. Mr. Humphreys, in his paper on "Some Notes on Economy in the Gas Business," gave some statistics which were very thoroughly dissected and compared by the members in the discussion which followed. It is needless for us to say that the treatment of "Generator Furnaces" was conducted in Mr. Greenough's usual masterly style. The discussion on this paper will prove very interesting to the fraternity at large in this country, where the importance of this topic is just about commencing to be appreciated. Mr. Slater's paper, on "Comparative Results between the Ordinary and the Dieterich Furnace in Benches of Retorts," contains valuable statistical information, and the Association acted very wisely in ordering the printing of the tables contained therein for immediate distribution among its members.

On the evening of the first day's session, Mr. George Shepard Page, of New York city, delivered his promised lecture on "Coal Tar and Residual Products." A large and brilliant audience, among which were numbers of ladies, listened with close attention to the eloquent and instructive address of Mr. Page. The lecture was profusely illustrated by means of the exhibition of many specimens of woolen, silk, and other fabrics colored and dyed with the aniline dyes.

During the session on the second day, Oct. 20th, the President read a very interesting communication on "Street Lighting in St. Louis, Mo.," showing what steps the St. Louis Gas Light Company had been taking in the matter of improved methods of street lighting by gas. Boston, itself, has shown the visitors what may be accomplished by a comparatively trifling outlay in this direction. We hope to be able to lay this communication in full before our readers.

At three o'clock the Association visited the works of the Boston Gas Light Company, where considerable time was taken up in sight-seeing and inspection. A very good opportunity was here afforded the members to witness the Dieterich Furnace in working operation. Before leaving the works the Association was photographed *en masse*. In the evening a banquet was tendered to the Association by the Boston Gas Light Company. Covers for 175 guests were laid at the Parker House, and a most thoroughly enjoyable time was had. The usual toasts were given and responses made, and the hour was late when the festivities ended.

On the third day the Association was bidden to consider itself as the guest of the New England Association of Gas Engineers; and, nothing loath, surrendered itself to the tender mercies of its Yankee brethren. A trip down Boston Harbor, to Deer Island, on which are located the public institutions of the city, was a pleasant feature of the day's experience.

Some little dissatisfaction has been expressed by those who had come from some distance to attend the meeting, on the ground that too short a time had been allowed for the business sessions of the Association. In the

selection of its future Chairman the Association has been peculiarly fortunate. Everyone knows the kind of gentleman that General Hickenlooper is, and his acceptance of the position of President is a guarantee that the usefulness of the Association will be enlarged and increased. One of the most gratifying things in connection with the late meeting has been the large accession of new members, no less than 29 names having been added to the roll.

Pittsburgh, Pa., was named as the place for holding the meeting of 1882; and on another page will be found the first installment of the Official Report of the proceedings.

THE MANUFACTURE OF WATER GAS.

Elsewhere will be found a letter by Mr. G. Ernest Stevenson, to the *Journal of Gas Lighting*, on the above subject. It is a summary of a paper read by Dr. H. Bunte, at Frankfort-on-the Main before the late meeting of the German Association of Gas and Water Engineers. The writer of the letter gives his own views of the comparative economy and efficiency of water gas and generator gas. The letter is clear and comprehensive, the deductions made are logical and worthy of consideration.

In addition to what is included in the above letter, Dr. Bunte went on to show that economies were possible to be obtained by modifications in the apparatus experimented with.

1. By the waste gas leaving the regenerator at an average temperature of 660°C.
2. By the water gas leaving the generator at a temperature of 500°C.
3. By the radiation of the apparatus, which had a temperature outside of 140°C.
4. By the losses due to clinkering, leakage and intermittent work.

It might be considered if an apparatus were so constructed that a portion of the above losses, which Dr. Bunte estimated at 37 per cent., was prevented, it would modify materially the present construction, and add largely to its cost.

It appears also that about 50 lbs. of coke were required for the fuel to heat the generator, regenerator, and decompose the steam for every 1000 cubic feet of gas produced. No account was taken of the fuel required to generate the steam and drive the blower, as the boiler from which the steam was taken was doing other work. For every 1000 cubic feet of pure water gas, consisting of equal parts of hydrogen and carbonic oxide, if all the steam is decomposed, there must be evaporated in the boiler 24 pounds of water. In practice a large quantity of steam passes the incandescent carbon without decomposition, thus compelling the evaporation of a greater weight of water. In some of the older methods of producing water gas the weight of water required was over 100 pounds per thousand cubic feet of gas. Undoubtedly this latter weight of water is not required to be evaporated by the methods now used; but, even with the best arranged apparatus, it is an important part of the total fuel expenditure, and, as well as the fuel required for the boiler, should be considered.

Danger Attending the Use of Electric Light.

The public have always been particularly advised, in glowing terms, by those interested in advancing at all hazards lighting by electricity that, among its many advantages, its safety, as regards life and property, was prominently to be considered. The public, ever ready for novelties, and eager to carry out their function, as they consider it, of aiding by their favor and means the so-called higher developments of science, have not deemed it wise to carefully scrutinize statements that a conservative member of society might consider to be partisan or exaggerated.

The innocence of the public might, perhaps, be called willful, as, among others, no less an authority than Mr. W. H. Preece has frequently called attention to the fact that the currents used in the production of the electric light were dangerous, and should be handled with great care.

The confidence so readily given by the public is being as radically changed into distrust as the accounts of the many accidents, resulting from the use of electricity, appear from day to day in the newspapers. A number of instantly fatal accidents have occurred, within the last two years, to persons who were handling the conducting wires or the lamps, and a number have been fortunate to escape after suffering severe shocks. The insurance companies have awakened to the necessity of some decided action, and, as noted elsewhere, the Board of Underwriters have given the question their earnest attention.

Perhaps the most striking evidence of the possibilities of this danger may be inferred from what happened at the Paris Electrical Exhibition, where one would think they would have been able to erect perfectly safe conductors; the competing electricians having much at stake, and being assisted by the most skilled workmen, who were well aware of the absolute necessity for everything to be right in the trial that was to take place before the public and experts in their own line; still, with all the precautions taken, several fires occurred from the overheating of the wires, and, in addition, a number of visitors suffered severe injuries. One is led, therefore, to imagine what the result would have been had the building been wired by the ordinary workman, little of whose work could be inspected by an expert.

But all of these accidents, except as showing the danger, were of minor importance as compared with the terrible disaster in Philadelphia. By this lamentable fire no less than nine lives were lost and fifteen persons were injured. An investigation was made and the coroner's jury, after examining a number of witnesses, found that the fire was caused by the improperly constructed and inefficiently managed electrical apparatus for lighting the buildings. A summary of the evidence, which was extensive, and the verdict of the jury, is given below—

"There were 29 witnesses altogether. The two great questions were: How did the fire originate in the Randolph Mills, and could the victims have been saved if proper measures had been resorted to? To determine these questions a score of employees were called to give testimony concerning the electric lights. Every one united in saying the lights were working badly. They would flicker up into a great glare, and then sink down and die almost out. There were two in the second floor, where the fire orginated, both of which had globes. In the third and fourth floors, where all the work was going on, there were six lights each, and these were without globes, as they gave a more brilliant light. Fires had been kindled there before by sparks from these electric lights. Warps of yarn and rags had been burned by them on different occasions. Ten minutes before the fire Atkinson, night watchman, had been on the floor where the fire originated. He saw the lights were not burning right, and went to the cellar to consult the engineer, thinking that he was running the generator unsteadily and that this was the cause of it. Together with the engineer they examined the machine and could find nothing wrong. A superintendent of the Maxim electric light company had been there that same day examining them, and had pronounced everything right. Before Atkinson could return from the cellar to the upper floors the building was on fire. Edward Gadsby, an Englishman and day foreman at the mill, gave important testimony. It was customary to run these electric lights on the second floor, where the fire occurred, in daytime on some occasions. On one occasion a light got out of order and the globe got red hot. The girls who were working near screamed, and he was compelled to stand near the light to prevent a panic. He never considered the lights safe after that. Daniel Killian, an employee of the Maxim electric light company testified that the rise and fall in the lights were caused by slight variations in the currents, one light sometimes robbing another. This he did not consider dangerous. The jury last night rendered the following verdict:

"The jury find that the deceased came to their deaths from burns and injuries received at a fire in the Randolph Mills, Nos. 1,711 and 1,713 Randolph street, Oct. 12, 1881. The jury find that the fire was caused by the improperly constructed and inefficiently managed electrical apparatus for lighting the buildings. The jury find that Jos. Harvey, owner of the mills, is criminally responsible for the loss of life, in neglecting to furnish proper means of escape in case of fire. The jury find that the city of Philadelphia is responsible for not enforcing the laws in compelling Joseph Harvey to erect proper fire escapes. The jury believe that the book-keeper, William R. Hassenpat, is censurable for not making some efforts to save the lives of the operatives instead of the effects of the office."—Philadelphia *Times*, Oct. 19.

The Ross Steam Stoker in London.

The London *Journal of Gas Lighting*, of October 18th, contains an account of the working of the Ross steam stoking machinery, as seen in action at the Nine Elms station of the London Gas Light Company. It is stated that the "settings had been very recently put in work on the occasion of our visit, and the heats were not quite at their full height; yet, notwithstanding this fact, four hour charges of about 3 cwt. were being worked off fairly well." It also states that the "whole apparatus is strongly made, easily managed, and contains nothing likely to suffer unduly from rough every-day usage in the retort house. At the present working twelve retorts are drawn and charged every two hours, and from the time the first lid was slacked off until the last retort was cleared out, on our visit, just twelve minutes elapsed. The working was by no means forced, as, for reasons given, the view in the retorts was not always clear. This still gives an average of one retort drawn per minute, including the time occupied by changing the rakes and traversing the machine the length of four settings. More important than the speed, however, is the thoroughness with which the work is done, and the simplicity of the service of the machines; ordinarily intelligent stokers soon learn to manage them to perfection. It is only necessary to say in concluding this notice of an interesting subject, that the experiments with the Ross machines at Nine Elms bid fair to be a continued success as regards everything that can be desired for practical working."

[Official Report.]

Ninth Annual Meeting of the American Gas Light Association.

Held at the Hotel Brunswick, Boston, Mass.,

Oct. 19, 20, and 21, 1881.

Morning Session—Oct. 19.

The Association was called to order at 11 o'clock by the President, Mr. William H. Price.

In the absence of the Secretary and Treasurer, Mr. George B. Neal was, on motion of Mr. Stiness, appointed Secretary *pro tem.*

The minutes of the last meeting of the Association having been printed and circulated among the members, the reading thereof, on motion of Mr. Slater, was dispensed with.

NEW MEMBERS.

Applications for membership from the following gentlemen were presented by the Secretary:

Charles D. Lamson, Boston, Mass.	P. Coyle, Charlestown, Mass.
Nathaniel Tufts, Boston, Mass.	Walter Wood, Phila., Pa.
John Cabot, Lawrence, Mass.	C. H. Nash, St. Joseph, Mo.
A. W. Copp, Boston, Mass.	Thos. B. Fogarty, Waterbury, Ct.
David Moore, Salem, Mass.	E. C. Learned, New Britain, Ct.
Jas. H. Armington, Brooklyn, N.Y.	A. P. Collins, New Britain, Ct.
D. H. Geggie, Quebec, Ca.	C. J. R. Humphreys, Bergen Point, N. J.
A. M. Fletcher, Indianapolis, Ind.	
Jacob L. Kuehn, York, Pa.	Chas. Watson, Camden, N. J.
Robt. Baxter, Halifax, N. S.	S. W. Whitney, Albany, N. Y.
Eugene H. York, Lynn, Mass.	Robert R. Dickey, Dayton, Ohio.
J. D. Brewer, Springfield, Mass.	W. H. Down, New York City.
W. P. Caliahan, Dayton, Ohio.	C. E. Hequembourg, Bradford, Pa.
Wm. Parrish, Seneca Falls, N. Y.	F. S. Richardson, N. Adams, Mass.
T. F. Rowland, Jr., Brooklyn, N. Y.	Robt. B. Taber, New Bedford, Mass.

On motion, the Secretary cast the ballot of the Association for the gentlemen named, and they were declared duly elected to membership.

PRESIDENT'S ADDRESS.

The President then delivered the following address:

Gentlemen of the American Gas Light Association—One brief year ago it was my good fortune to greet you in the metropolis of the Northwest, and to-day it is my pleasant duty to extend to each and all a cordial greeting in this the time-honored capital of the Northeast.

It is a matter of special congratulation that during the last year but few of our number have fallen by the way. The dread Reaper has, indeed, been fearfully busy, but he has gathered few sheaves in the field we have occupied.

The year just passed has been one of striking vicissitudes. When we met in Chicago, a fierce political contest was raging. Soon after the ballots were cast the result was declared, the tempest was hushed, and in due time the man who had been elected President was inaugurated, and entered upon the duties of his high office. The country seemed to have commenced a term of peace and prosperity. Political differences were laid aside; extraordinary business activity prevailed on every hand. Suddenly the whole country—aye, the whole civilized world—was shocked by the deed of an assassin having few parallels in history. Then followed the long vigil at Washington, and the briefer one at Elberon. The last act of the dreadful tragedy has but lately closed, and now the victim sleeps in Lake View, near the shore of that beautiful inland sea, which had been to him a beauty and a joy in his youthful days.

We are, most of us, citizens of the Republic, and as such are interested in its daily history. In this fact I trust I may find an excuse for this brief reference to a great election and to the great public calamity to which I have alluded.

The last year has been remarkable for the severity of its winter and the fierce heat of its summer. A drought of unusual severity has smitten a large portion of the country, and has greatly diminished the natural product of the later harvest. Extensive fires have ravaged large districts, and in one State they have caused a fearful loss of life and an immense destruction of property.

But it is a matter for surprise that, notwithstanding the striking incidents to which I have adverted, business has gone forward with amazing activity, and its volume has attained immense magnitude. The laborer is fully employed and amply rewarded. The artisan finds every incentive to the exertion of his highest skill; the brain of the inventor is stimulated to greater activity in all directions, and every day witnesses some new success. Results of which our fathers never dreamed have been realized, and we are no longer astonished by inventions and discoveries which two hundred years ago might have subjected the inventor and the discoverer to the unhappy fate of the wizard and the sorcerer.

Leaving these general topics, I beg your attention to the interest which we represent, and which it is our business to promote.

It is safe to say that never before, since lighting by carburetted hydrogen came into use, have such vigorous efforts been made to supplant it as during the last year. The brain of the scientist, the cunning hand of the mechanic, and the purse of the capitalist have been enlisted in this crusade. Great expectations have been indulged that electricity would furnish the light of the future. Nearly or quite every week some new device for utilizing this agent has been announced, and most extravagant anticipations have been proclaimed. Every new exhibition of the light has been declared a "perfect success." Unquestionably an immense amount of ability of all sorts has been displayed, and many parties engaged in "promoting" electric lighting schemes have been very successful in the main purpose—to wit, the making of money.

It will be readily admitted that some progress has been made in rendering the electric light less objectionable; but after the utmost exertions to make the light acceptable, it is unsteady, occasionally goes out unceremoniously, and in its best estate is exceedingly disagreeable, and even injurious, to the eyes of many. I refer to the arc light, more especially in the last remark. As to the systems of incandescent lighting, which are many, besides being liable to the contingencies of unsteadiness, extinction, and sudden destruction of the lamp itself, the light does not seem to me to challenge comparison with good gas light.

On the question of the cost of the electric light, there is much difficulty in getting at the truth. So far as I can learn, the arc light costs fully double a fair price for gas when used for street illumination, and when used inside of stores, and ordinary shops, saloons, etc., about three times as much as gas should cost.

But were the electric light more steady, reliable, and cheap, in my judgment there is a fatal objection to its use—to wit, the quality of the light. The absence of the yellow ray is a fatal objection to it. Infinite wisdom created sun light, and any light which lacks its essential qualities is unfit for general use. Any artificial light should be soft and diffusive. The electric light is neither; gas light is both.

But illuminating gas is capable of giving much more light per foot than we have been accustomed to get from it. We are but just beginning to learn the proper methods for securing the best effects from the combustion of gas, and the manufacturers of gas are under great obligations to Sugg, Bray, and others for the skill and energy they have displayed in this department. Gas managers should awake to the importance of promoting a better knowledge of this subject.

It is not worth while to go into this matter at length, but I will refer you to an example of energy and liberality recently displayed by the St. Louis Gas Light Company, which was so successful that it extorted unwonted praise from the merchants on the streets specially illuminated in that city. If desired, I will at the proper time read to you a full description of what was done on the occasion referred to. That, however, was a well executed effort to exhibit the power of gas in the department of street illumination. But we need to educate the people in the art of using gas in their homes and places of business. When one walks a business street at night and sees some places beautifully lighted with a moderate consumption of gas, and other places very imperfectly illuminated, and sees at a glance that the difference is due solely to a skillful selection and adjustment of fixtures in the one case, and to an unfortunate want of skill in selecting and adjusting fixtures in the other case, he feels the need of intelligent work in that field, and is tempted to send a missionary to labor there.

I think it is also true that we are but just beginning to understand the vast capabilities of gas in other directions. I believe that it will be largely the fuel of the future. By it our food will be cooked; by it our linen will be laundried; by it our houses will be warmed; by it our machinery will be driven; it will furnish heat for many operations in metallurgy. The practical question to-day with every gas manufacturer is: What steps must I take to enable me to sell gas so low that it may be used profitably for cooking, for laundry purposes, for warming, for motive power? All these uses may be added to that of illumination, and, what is specially desirable, they will give a day-light employment to our mains.

It has recently been stated, on good authority I suppose, that in one of the cities of France one-third of all the gas made by the works there is consumed for purposes other than illumination. What a difference in the future of many a gas company would take place could its business be increased by an extension of the uses of gas, so as to require an increase of its make equal to one-third of its present sales for lighting. It is not unreasonable to believe that a much greater change than this will occur in process of time.

But other movements likely to result in great benefits to the gas industry are approaching. The time is at hand when the American gas manufac-

turer will realize largely from his residual products. Not long hence American coal tar will yield to skill and capital the wonderful qualities which have been a source of wealth to those who have manipulated the coal tar of the old world. Ammoniacal liquor, too, will be made to yield its value here as it has long done abroad.

Again, great improvements in furnaces are being made. It is not my purpose to attempt any indication of what may be the best furnace to adopt. I think the truth is slowly evolving, and that the fittest will survive and be adopted. When this shall be done, the efficiency of the bench and of the retort will be greatly increased, and the quantity of both fuel and labor required will be much reduced.

To me it is equally clear that labor-saving machinery for handling coal for charging and emptying retorts will soon come to the aid of the gas manager, as it has come to the aid of many other departments of production, and with equally beneficial results. This will be one of the elements in solving the problem before us.

Gentlemen, it is time to conclude these desultory remarks. I have had little time for preparing a careful discussion of any of the many special topics which demand investigation. I trust you will be favored with papers upon some of these, and that the discussions which may follow their reading will be full, frank, and instructive.

To me it is clear that the strenuous exertions made for the introduction of electric lighting have been productive of great benefit to the industry we represent. The gas fraternity, if the phrase be allowable, has been rudely awakened. Their right to occupy the field of public and private illumination has been vigorously challenged, and a rule has been asked that we show cause why our industry should have a continued lease of life. The gas manager has been put upon his mettle. He has been driven to effort in behalf of the interest intrusted to him, and the result thus far has been a prodigious advance in all directions.

For one, I believe that the prospects of this industry were never brighter than they are to-day. Its field of usefulness is widening; its cost of production and distribution is being reduced; and gas light is to be brought within the means of all. We have met to aid this consummation. Let us compare notes, compare experiences, compare theories; and may we be able to carry away enlarged views and increased knowledge.

REPORT OF THE EXECUTIVE COMMITTEE.

The Secretary then read the report of the Executive Committee, as follows:

The Executive Committee respectfully report that in the absence of Mr. White, the Secretary of the Association, they elected George B. Neal, of Boston, Secretary *pro tem.* of the Committee.

They also report that, for non-compliance with the rule relating to the payments of assessments, the names of seven members have been stricken from the roll.

The Committee also report that they have carefully examined the following papers, and approve them to be read before the Association at this time:

"Some Notes on Economy in Gas Business," by C. J. R. Humphreys.
"Generator Furnaces," by M. S. Greenough.
"Coal Tar as Fuel for Benches," by F. C. Sherman.
"Gas Stoves for Heating Apartments," by T. O'Connor Sloane, Ph.D.
"Comparative Results Between the Ordinary and the Dieterich Furnace in Benches of Retorts," by A. B. Slater.

The Committee recommend the printing of the tables presented by Mr. Slater as soon as practicable, for the use of members.

F. C. Sherman,
A. C. Wood,
T. Littlehales,
Samuel Prichitt,
Executive Committee.

TREASURER'S REPORT.

The Secretary read the Treasurer's report, as follows:

Sept. 30, 1881.

Receipts.

To cash balance, Oct. 1, 1880	$1,113 54	
Dues for 1878	5 00	
Dues for 1879	5 00	
Dues for 1880	70 00	
Dues for 1881	655 00	
Dues for 1882, in advance	15 00	
Initiation fees	140 00	
Interest on deposits in savings banks	46 50	
Sales of copies of Proceedings	17 50	
		$2,067 54

Disbursements.

Trunk for books and papers	5 50	
Storage and insurance	7 60	
Secretary's expenses, Chicago meeting	59 00	
Stationery	8 00	
Printing notices	2 25	
Printing Volume IV. of Proceedings	787 10	
Sundry expenses, postage	86 80	
Salary of Secretary and Treasurer	300 00	
Deposits in savings banks	634 60	
Balance in Treasurer's hands	177 29	
		$2,067 54

Wm. Henry White, *Treasurer.*

Examined and found correct.
A. B. Slater,
G. S. Hookey,
Finance Committee.

On motion, the report as read was received, recorded, and placed on file.

Mr. Slater, of the Finance Committee, reported that his associates had examined the accounts of the Treasurer and found them to be correct; that they held bank books for the amount stated to be on deposit, and the check of the Treasurer for the balance.

On motion, the report of the Finance Committee was accepted.

NOMINATION OF OFFICERS.

On motion of Mr. Neal, the President named as a committee to present the names of suitable persons to fill the offices of the Association for the ensuing year the following gentlemen:

W. H. Dennison, Pittsburgh, Pa.; M. S. Greenough, Boston, Mass.; Thomas Butterworth, Rockford, Ill.; J. H. Armington, Brooklyn, N. Y.; Thomas Turner, Charleston, S. C.

Mr. Pratt—There are a good many gas companies in this immediate neighborhood, and connected with them are many gentlemen who are more or less interested in the objects of this Association. I therefore move that the officers and directors of gas companies who are not members of this body be invited to attend the meetings of the Association, and listen to the reading of the papers and the discussions which may be elicited.

Mr. Harbison—I think the better plan would be to so amend that motion as to give the members of the Association permission to invite gentlemen who are connected with gas companies to be present at the meetings and to hear the reading of the papers and the discussions. I do not think it would be wise to issue an indiscriminate invitation to everybody to come in to our meeting; but let us give to each member the right to invite into this room those who are connected with his company.

Mr. Pratt—I accept that suggestion as an amendment. There are one or two in my own board—scientific gentlemen too—who would very much like to attend our meetings, and whom I should be very glad to see here.

A Member—Would it not be well also to invite the gentlemen to participate in the discussions if they saw fit? Some of the visitors will be scientific gentlemen who might give us much valuable information.

The President—That was not included in the original motion of Mr. Pratt. Personally, I should be glad to hear from such gentlemen.

Mr. Harbison—I do not think that we had better open the door too wide. We can extend a special invitation to any gentleman from whom we may wish to hear; but I do not think we had better extend an invitation to address us to any and every gentleman who may happen to be present at our meetings. We may, at any time, having special reference to our own interests, invite any gentleman to take part in the discussions; but I think it would not be well to open the door as widely as is now proposed.

The President—It may be arranged in this way—whenever any member makes a motion that any scientific gentleman present be invited to address us, or to participate in a discussion, the Association will be very glad to listen.

The motion of Mr. Pratt, as amended by Mr. Harbison, was then agreed to.

Mr. Neal—I move that a committee be appointed by the Chair to recommend a place for holding the next annual meeting, and that they report at some time before the close of the session. I ask that I be left out of the committee.

The motion was agreed to, and the President appointed as such committee—

Messrs. J. H. McElroy, Pittsburgh, Pa.; A. M. Fletcher, Indianapolis, Ind.; Geo. D. Cabot, Lawrence, Mass.; T. Littlehales, Hamilton, Ont.; W. H. Miller, Columbus, Ohio.

READING OF PAPERS.

The President announced that the next business in order was the reading of papers.

The Secretary then read the following paper, by T. O'Connor Sloane, Ph.D., of New York city, on

THE USE OF GAS STOVES FOR HEATING APARTMENTS.

Since the recent development of the manufacture of gas stoves the question has been frequently asked, "Should gas be burned in a luminous or non-luminous flame to produce the most heat?" The perfect gas stove is one that produces the best result with the least expenditure of gas. From this undoubted truth the manufacturer draws the conclusion that, in a perfect gas stove, the gas should be so burned as to produce the most heat. This, also, is perfectly true; but it will appear that it is a-begging of the question. Let the gas be completely burned, so that no carbon monoxide is formed, and it matters not whether the flame be luminous or not. The same amount of heat will result. All that is required is perfect combustion of the gas, and this is secured by numberless well-known burners. Argands, batswings, Bunsens, and other properly constructed air-burners, effect it. This part of the problem was solved years ago.

It is true that to produce an intense heat we must use a non-luminous flame. The ordinary flame is full of little particles of carbon heated to a high temperature. These particles transform the obscure heat of the gases in combustion into radiant heat, and radiate it in all directions away from the flame. This causes a reduction of temperature in the flame, as the heat thus radiated expends itself on surrounding objects.

The non-luminous flame of the Bunsen burner is a pure gas flame, containing no solid matter. Gases are very poor radiators. As the flame, therefore, contains no solid particles to radiate its heat into space, the heat is concentrated in itself, and its temperature is high. The total amount of heat is the same in both cases, the Bunsen burner only localizes it.

To illustrate this we may imagine the two flames submitted to a calorimetric test. They are rated to burn an equal amount of gas, and are introduced into two separate tubes. The tubes are surrounded by water, each one having its separate water jacket. The same amount of water at the same temperature is placed in each. The tubes pass through the water with many convolutions. In these tubes the flames are permitted to burn a given time and the temperature of the water is taken. It will be the same for each, proving that the total heat is the same for both flames. Suppose that the flames are next subjected to a similar experiment, except that they are held below the calorimeter tubes, so that the gases of combustion pass upwards through them, while the flames are in the open air. The water heated by the luminous flame will in this case receive less heat. A part of the heat of this flame will be radiated into space, and not received by the water of the calorimeter.

The first experiment proves that the total amount of heat is the same; the record shows how the luminous flame divides the heat into two parts. It splits it up into radiant and common heat.

The identity of radiant heat and light is here assumed. For the purposes of this discussion they may be considered the same.

This illustrates the difference between a luminous and non-luminous flame, and shows that the difference is one of character only.

If all the heat be utilized one is as efficient as the other. The gas stove maker should busy himself with the construction of the stove. When he considers the question of burners he should consider it only as a matter of appearance, not of economy. Even then it is a very important question, and hard to solve. Gas stoves do not generally have the pleasing effect of an open coal fire.

In the light of the present day we may assume that gas stoves should have flue connections to carry off the products of combustion. The heat that such a stove communicates to a room is measured by the total heat due to the combustion of the gas *minus* the heat that goes up the chimney. It heats the room by radiation from, and contact of the air with its surface. It follows that the heating surface should be as large as possible. A form of construction similar to a vertical tubular boiler, as an instance, would be very effectual. It should also be a good radiator. Dark colored, unpolished surfaces, as a rule, radiate heat the best. Finally, in order that it may quickly receive and transmit the heat of the flame through its substance, it should be a good conductor of heat. These conditions are well fulfilled by blackened iron. The less polish there is about it the better. Tiles and earthenware, however pretty, will be found ineffective, as they are bad conductors of heat.

The stove is principally heated by the contact of the gases of combustion with its interior surface. To make this contact as perfect as possible the area of interior surface should be large in proportion to the volume of the gases of combustion, and of the heated air passing through the stove with them. The volume of such gases and air should, therefore, be as restricted as possible. Enough air should be admitted to completely burn the gas, and no more.

As a practical matter perfect combustion of the gas could be readily ensured by the admission of twenty times its volume of air. Taking this as a minimum, any additional air that is admitted to the stove carries off heat. Hence it follows that gas stoves should be provided with air checks to admit about twenty times as much air as the stove is burning of gas and no more.

Gas stoves have been tested by observing the increase of temperature imparted by them to a room. This seems a practical and common-sense way, yet it is not. So many sources of error are inherent in it that it is quite unreliable. The following method of making comparative results may be suggested.

The general statement of it has already been made. Measure the total heat produced, and the heat that goes up the chimney. This must be done relatively for each stove. The difference between the two quantities of heat in each case gives the relative efficiency of the stoves.

Suppose two stoves are to be tried. They are made to burn gas at the same rate. This amounts to a relative measurement of the total heat. The stoves must communicate with the chimney by pipes of equal size. The pipes should be flattened in section, and an equal length of each surrounded by a water-jacket. Equal measures of water of the same temperature are poured into the water-jackets, allowed to remain there an equal time, withdrawn, and the temperature of each taken. This gives the relative amounts of heat lost. The stove that heats the water the least is doing the best work.

The above is capable of development. It is only given as a practical, easy test.

The same amount of gas should be burned in each stove. But it may be that one is constructed to burn more than the other. In that case the test would be an unfair one. While this complication could be allowed for, a trial of efficiency between stoves of different sizes will be unsatisfactory, much as a race between yachts of different tonnage; the question of "time allowance" is always a perplexing one.

It must not be forgotten that most of the above refers to stoves used for warming apartments. The conditions to be met in constructing cooking stoves are widely different.

The President—It is obvious that this paper deserves great attention, and that it is likely to develop considerable discussion. There are gentlemen here who have been engaged in the manufacture of gas stoves, and is desirable that they should give us whatever light (and heat, too,) that they have upon this subject. There is scarcely time, before the recess, to enter upon the discussion at any length; but I hope it will be taken up this afternoon and thoroughly ventilated.

The Association then took a recess until two o'clock, P.M.

AETERNOON SESSION—OCT. 19.

The following telegram was read by the Secretary—

"*Chas. W. Isbell, Parker House, Boston, Mass:*

"Machine shop burned last night; total loss; foundry, pattern shop and patterns safe. Come home to-night. Answer.

"GEO. G. PORTER."

On motion, the Secretary was instructed to send the following telegram to Mr. Isbell, as representing the Smith & Sayre Manufacturing Company, expressing the sympathy of the Association in the serious less sustained by that company—

"BOSTON, MASS., Oct. 19, 1881.

"*C. W. Isbell, Secy. Smith & Sayre Mfg. Co., N. Y.:*

"By unanimous vote the American Gas Light Association extends its warmest sympathies to you on account of your severe loss by fire last night.

"GEO. B. NEAL,
"*Secy. pro-tem.*"

Mr. C. J. Russell Humphreys, of Bergen Point, N. J., then read the following paper on—

SOME NOTES ON ECONOMY IN THE GAS BUSINESS.

Whatever differences of opinion there may be as to the future of gas and electric lighting, and their prospective mutual relation, on one point there can be little doubt—namely, if gas is going to hold its own, and, further, if it is going to enter fields wherein it is at present comparatively unknown, the utmost economy must be practiced, not only in the manufacture of gas, but throughout the whole gas business. Let us state at once, in order to avoid any vagueness, that when we refer to the introduction of economy in the gas business, we allude not to that, we fear, far-distant time when the

receipts from the residuals are to offset the cost of gas making, but have in mind the economies which have been and are at the present time practiced by so many companies. It is not necessary to recapitulate all that has been done in this direction. We have excellent abstract evidence on this score, in the almost universal reduction in the price of gas—a reduction which cannot be explained by diminished dividends, or by any falling off in the price either of material or labor, but must be credited to greater economy in the conduct of the gas business.

Obviously, in a paper like this, it is not possible to lay down laws which can be applied by all, or even by the majority of gas companies; we can only call attention to a few points which come under the head of economy in the gas business. If we succeed in setting some managers thinking, if we are able to induce some who have already done excellently in this direction to go on and do still better, we shall feel well repaid for our trouble.

At the very outset, there is a fine opportunity for the display of economy in the purchase of raw material. Now, there are many local circumstances which must influence the manager on this point. Some are in such close proximity to coal mines of an indifferent reputation, but on account of their nearness and consequent cheapness, it would pay them to use, rather than go further for a better article. Then there are some works so situated that the cost of the coal is disproportionately increased by carriage rates; it may be either in some city at a distance from the mines, and the increase due to freightage, or it may be a works built at a distance from water access or railroad. In such cases it will, as a usual thing, be economical to buy the best coals, even at an advanced price, as obviously it costs the same to move a ton of poor as a ton of good coal; therefore, by buying the better article the cost per thousand feet of gas for carriage would be somewhat diminished. Thus it might be advisable for a company situated at the disadvantage we have shown to use some of those coals which, though rich in sulphur, give a high yield of good gas, while another works would find the increased cost of purification more than offset the gain in the yield and quality of the gas. But it would be tedious to amplify in this direction. This sample hypothetical case will show that, even in the matter of coal, what is economy for one manager is not necessarily such for another.

Having determined on the kind of coal best suited to his wants, the manager will find that much can be done in the purchase of his supply by watching the market; but those who, taking advantage of a cheap rate, lay in a large supply, should not forget to deduct a little from their apparent gain to cover the depreciation that coal suffers by long storage. Again, we know of some managers, whose works are at a distance from the mines, where half of the cost of the coal delivered is due to freightage, who, instead of buying their coal delivered at their dock, buy it at the shipping point and take the coal when the vessel rates are low.

Then comes the matter of stacking the coal. In large works we find this done in a large measure by mechanical appliances. Either the coal passes to the sheds or the retort houses by an overhead railway, or, where it is brought from the dock on the ground level, tubs receive it at the surface, whence it is raised by hydraulic elevators or other suitable hoisting apparatus to the top of the shed, and then carried along a track to the desired point.

At small works we find the coal shoveled from platform to platform till it reaches the topmost point. This manner of stacking coal involves a great deal of labor. Now, each of these plans may be more economical in its respective place, but we fear there are some works where the quantity of coal used in a year has been growing little by little until, unnoticed, it has assumed such a figure that what was an economical procedure a few years ago is so no longer.

The chief factor of a case of this kind, as in so many others, is the interest on the investment. But when this item plus the running expenses of the machinery is less than the amount spent for labor, then the economy of a change suggests itself.

Probably getting coal from the shed to the retort house affords greater scope for the display of economy than any point we have yet noted. This question is, however, so closely related to the next stage—namely, charging the retorts—that it is difficult to treat them separately. We may note at the outset that too much stress cannot be laid on having the coal shed built in as close proximity to the retort house as possible, and also on a higher grade, in order to facilitate the bringing in of the coal. By a careful study of the formation of the land this desideratum could in many cases be easily secured. And it is an important point, for if the works be small and the coal be brought in by hand, one man will be sufficient if the grade be down hill, where two would hardly do were the incline in the wrong direction. In passing let it be noted that a track between the shed and the retort house will be of service even in a small works. Taking the case of a medium and a large works, the means of transit for the coal which offers the most advantages is an overhead track running parallel with the retort house, either inside or just outside the house, with bins adjacent thereto. The cars or tubs to be filled in the coal shed, and by the aid of a hydraulic elevator or other suitable hoisting apparatus raised to the overhead track. Of course, where a mechanical stoker is used this mode of handling the coal, or something similar, becomes almost a necessity; but even where a mechanical stoker, so called, is not employed, the advantage of this method of working the coal offers many inducements.

It has been shown in an article which appeared recently in the London *Journal of Gas Lighting* that the Ross stoker can be economically employed in a works where, at the time of minimum consumption, 36 retorts are in action. While there are not many large works, in the ordinary acceptation of the term, in this country, yet the number where 36 retorts are in use in the summer season is by no means small. We may therefore look for the more general introduction of this excellent apparatus in the near future; and this will be one great stride in the economy of the retort house, for where it is used there is no superfluous handling of the coal.

Where, however, the adoption of this apparatus is not considered advisable, or where the works are too small to warrant the innovation, there the improvement of the common system should receive attention. Consider the present mode—how the coal is shoveled into wheelbarrows or wagons, brought into the retort house by hand, dumped on the floor, and shoveled into the scoops. The scoops are then raised from the floor and thrust into the retort. Now, here is unnecessary work at once, for the coal, when in the barrows or wagons, is at a height of about two feet from the floor; instead of advantage being taken of this, the coal is dumped on the ground and has to be raised up afterward by the stokers. This may seem at first thought a small matter—its mention may excite a smile of ridicule; but a moment's consideration shows this two feet of lift to be the most difficult part of the operation of elevating the scoop, for the stoker has to expend his strength while in a stooping posture; and in a works carbonizing 100 tons of coal a day it is equivalent to the raising of 200 tons a foot high or one ton 200 feet high. This, be it noted, is, as a general thing, unnecessary labor, for if the wagons used for bringing in the coal were made with only three sides instead of four, and with flat bottoms, the coal could be shoveled directly from them into the scoops, the latter being supported on a light frame of about the same height as the wagon. Of course, in such a case it would be necessary, where regular men are employed for bringing in the coal, to have extra wagons; but that would be a small matter. Again, if the coal were brought in by an overhead railway at the side of the retort house, and dropped into bins adjacent thereto, we would be able to charge the retorts with even greater economy; by the aid of proper shutes the coal could be conducted by gravity to a point a few feet inside the retort house wall, and in front of the bench.

The problem then to be solved would be, what economical means could be devised for transfering the coal from this point to the retorts. In lieu of a better arrangement the following might be made to answer: Have a pair of overhead rails laid along the house parallel with the stack, one rail being just in front of the ascension pipes, the other 6 or 8 feet in front of this; the height of the track to be about 2 ft. 6 in. above the bottom of the top retorts. Upon these two rails a carriage consisting simply of two wheels, with the joining axle, would run, this axle to be so shaped as to permit a grooved wheel to run on it. From this wheel the charging scoop could be suspended by any simple mechanism that would permit it to be easily raised and lowered. In default of any other appliance, the ordinary chain tackle, such as is used in small works for raising purifier lids, would answer. By this means the scoop could be run back and forth from the filling place to the retort, and could be raised or lowered to the level of any retort, while the carriage, traveling back and forth the length of the house, would allow of the scoop being brought opposite any bench or any retort of that bench. Motion could be imparted to the carriage by means of two ropes, covered with leather to reduce friction, attached to either side of the carriage, then passing over fixed friction pulleys attached at the two extreme points of the machine, and then back to a point underneath the carriage where they would be within easy reach of the operator. A couple of men could do a good deal of charging with such an arrangement as this, with less fatigue than they usually experience. One man would suffice to steady the scoop in its transit from the filling point to the retort; but if large scoops be used, such as would hold a full charge, it would require two men to thrust it into the retort. In order to reduce the work of moving the scoop between the two points, the transverse rail, or the axle of the carriage, could be made with a small incline toward the retort. In regard to drawing the retorts, little can be done for the amelioration of this labor without the aid of power stokers.

The charging of the retorts followed the bringing in of the coal in such natural sequence that we have been led past the very important matter—the style of bench. The two points to be aimed at in devising a setting are durability of the retorts and economy in fuel. Some engineers endeavor to secure one of these benefits without regard to the other; consequently we have many settings wherein a large quantity of tiling is used, and, on the other hand, some that are simply skeleton settings. Here, as in many other

points, there is a happy medium. It is generally found that the bench which contains just enough tiling to properly support the retort gives, all things considered, the best results. A setting in common use in this country has the flues running under the bottom retorts. The top tiles of these flues form a bed for the retorts. Some engineers omit this tiling, making the bottom of the retort act as a top to the flue, and claim that they obtain a better heat in these two retorts with less fuel. As to the number of retorts to the bench, six seem to work out the best in this country, where high heats are in general use. Where generator furnaces are employed another retort may perhaps be added.

This matter of improved furnaces is one of the interesting questions of the day. This subject has advanced to that point where the majority of managers are willing to admit that the principle involved is correct, but are waiting to see it embodied in a furnace that will meet all our wants. It would be out of place here to enumerate all the styles of furnaces or to describe their working. This much can be said, that they have been sufficiently tried to establish their economy and warrant engineers in adopting one of the many, while they are waiting for the ideal furnace. They have already shown economy in fuel, economy in labor, economy in the use of cannel. The first two items stand out more conspicuously when they are figured, as they should be, at so much per 1,000 feet of gas made, and not by the ton of coal carbonized. Where the common furnace is in use, fuel and labor can be economized by firing with hot coke. In a paper read at the last meeting of the French Association it was shown that a saving of fuel to the extent of about 3 per cent. resulted from this plan. But there is a further gain in tending to maintain a more uniform heat, and this, we all know, means better gas and more of it from a given quantity of coal. The time and mode of clinkering and firing up are points worthy of attention, adjusting these matters that the most heat is given out when the most is required.

Recent investigations have shown the lack of economy which characterizes our most common mode of condensation. It being clearly established now that when tar is eliminated from the gas by condensation, some of the light-giving constituents are found in the tar well which ought to be in the gas, and, secondly, the deposition of naphthaline is promoted; hence hot scrubbing affords a double economy, in that the use of cannel can in a great measure be dispensed with, and the trouble from naphthaline reduced. In this connection let it be remarked that the higher the temperature under which such an apparatus works the better the result. And it would appear as if the heat escaping from the top of the retort stack might be utilized for this purpose by allowing water or air to circulate through pipes placed on top of the stack, then using this heated air or water to keep the apparatus hot. Again, the heat of the gas itself might be conserved by making the filling of the apparatus of wood or other non-conducting material.

Ammonia is another matter worthy of consideration. It is economy to invest money in an improved scrubber rather than use a poor machine and allow the liquor to run to waste. In purification we can choose between the two agents lime and iron. Where the latter is used, it would seem the part of economy to supplement it with lime rather than permit the CO_2 to remain in the gas. Where lime is used, the method of working it given us by Mr. Forstall seems to be the most economical.

We will now endeavor to ascertain what figure gas can be made for in a works where the economies we have mentioned are practiced. We will take a works of an average make of 1,000,000 feet a day, and consider that it is situated on a water front We will presume that the coal as unloaded from the vessels is dumped into cars on an overhead railway; that the cars run either into the coal shed or to the bins, as required; that one-quarter of the coal *does* go direct to the bins; that standard coals are used, and the price of such is $4.50 per ton of 2,240 lbs., delivered either in the sheds or bins. The yield we will place at 11,200 feet per ton, 16-candle gas being supplied. No enricher. We will further consider that improved furnaces are used—the Dieterich or something similar; that the Ross stoker is employed, and that the tar is eliminated by hot scrubbing; that Forstall's system of purification is in use. Besides the boiler house adjoining the exhauster house, we will presume there is one other, which we will designate the second boiler house; therein will be placed the tar and ammoniacal liquor pumps, and the boiler which will supply steam for these, as well as for the engine in the coal shed and that at the dock. As one-quarter of the coal passes direct to the bins, the coal shed men will be employed only three-quarters of the time; the balance will be spent at the dock, and this part of their wages will be included in the price of coal delivered in bins or sheds. We will consider that breeze is used in exhauster house boiler for fuel. In our estimate we will endeavor to keep each division of the work separate to a certain extent. Twenty benches of sixes would be required, 225 lbs. of coal being charged per retort, the charges to be worked off in three hours. Our make per retort would be 9,000 feet per diem; hence by allowing 7 per cent. of the retorts to have scrufflers in, our make would be a little over a a million feet a day.

Daily Expenses of a Works Making on an Average 1,000,000 *Feet a Day.*

		For Day.	Per 1,000 feet of Gas.
89.28 tons of coal, at $4.50	$403 76		
Less residuals, as follows:			
Coke, allowing 38 bush. per ton of coal — 105.5 chs. less 25 per cent. used under retorts = 79.1 chs. at $2.52	$199 33		
Tar, say 33 cts. per ton of coal carbonized	30 00		
Ammoniacal liquor, say 16½ cts. per ton of coal	15 00		
	244 33		
		$159 43	15.9 cts.
Expenses in coal shed—			
1 engineer, $2 a day, three-quarters time.	$1 50		
3 shovelers, $1.50 a day, " " ..	3 38		
3 wagon men, $1.50 a day, " " ..	3 38		
Oils, etc., for engine and hoist	30		
Repairs to machinery, at 10 per cent.	28		
Repairs to coal wagons	13		
Extra coke used on account of this engine, 10 bush. at 5 cts.	50		
		9 47	00.9 cts.
Retort house—			
Ross stokers, depreciation at 10 per cent..	$2 74		
Repairs to same, at 7 per cent	1 92		
Engineers for stoker, 4 (2 day and 2 night), at $2.25	9 00		
Assistants for stoker, 2 (1 day and 1 night), at $1.75	3 50		
Coke for stoker, 80 bush., at 5 cts.	4 00		
Oil, etc., for stoker	50		
		21 66	02.1 cts.
Lidmen, 4 (2 day and 2 night), at $1.75..	$7 00		
Clinker men, ditto, at $2	8 00		
Coke men, ditto, at $1.50	6 00		
Repairs to tools	50		
Repairs to retorts, at 4 cts. per 1000 ft...	40 00		
		61 50	06.1 cts.
Coke shed—			
2 men for day and 1 at night, at $1.50		4 50	
Exhauster house—			
Engineers, 2 (1 day and 1 night), at $2.25	$4 50		
Oil, etc	50		
Repairs to boiler and machinery, at 5 per cent.	82		
		5 82	00.6 cts.
Second boiler house—			
Engineer	$2 00		
Fuel, 10 bush. coke, at 5 cts	50		
Oil, etc	25		
Repairs, 5 per cent	30		
		3 05	
Purifying house—			
3 men, at $1.75	$5 25		
Lime, 100 bush., at 6 cts	6 00		
Repairs to purifiers	75		
		12 00	1.2 cts.
1 yard man		1 50	
Foremen (1 day and 1 night), at $3		6 00	
Assistant foreman		2 00	
Salaries chargeable to manufacture, at $5,000 a year		13 70	01.3 cts.
Repairs to works not included in above, say $200,000 at 5 per cent		27 40	02.7 cts.
Sundries		5 00	
		$333 03	33.3 cts.
To which must be added gas used at works, say 1,700,000 feet per year, at 36 cts. per 1,000		1 67	
Total		$334 70	33.4 cts.
To put these improvements in old works would involve an investment of, say, $40,000; interest on this amount at 6 per cent.		6 57	00.6 cts.
		$341 27	34.1 cts.

Statement Showing Daily Expenses of a Works of an Average Make of 324,000 Feet.
Figured on a basis of the average daily make of each quarter.

	May, June, July.	Aug., Sept., Oct.	Nov., Dec., Jan.	Feb., Mar., Apr.
Average daily make of gas	225,000 ft.	320,000 ft.	423,000 ft.	328,000 ft.
Number of benches in use	5	7	8	7
Tons of coal used	20.1	28.7	37.8	29.0
Cost of coal	$90 45	$129 15	$170 10	$130 50
Less residuals—				
Coke	40 07	57 21	75 61	57 96
Tar	6 63	9 47	12 47	9 57
Ammoniacal liquor	3 31	4 73	6 23	4 78
Net cost of coal	40 44	57 74	75 79	58 19
Coal Shed—				
Labor	1 50	1 50	3 00	2 25
Hoisting	60	87	1 11	87
Repairs to wagons	05	05	05	05
Ross Stoker—				
Depreciation	1 92	1 92	1 92	1 92
Repairs	1 37	1 37	1 37	1 37
Engineers	4 50	4 50	4 50	4 50
Coke	1 75	2 50	3 25	2 50
Oil and sundries	25	25	25	25
Total for stoker	9 79	10 54	11 29	10 54
Clinker men	4 00	4 00	4 00	4 00
Coke men	1 75	3 00	3 00	3 00
Repairs to tools	15	18	21	18
Repairs to benches	9 00	12 80	16 92	13 12
Total for retort house, coal, and coke sheds	67 03	90 68	115 37	92 20
Same, less cost of coal	26 59	32 94	39 58	34 01
Exhauster House—				
Engineers	4 50	4 50	4 50	4 50
Sundries	20	25	30	25
Repairs	30	37	44	37
Purifying House—				
Lime	1 35	1 92	2 54	1 96
Labor	1 75	1 75	1 75	1 75
Repairs	25	25	25	25
Salaries chargeable to manufacture	6 85	6 85	6 85	6 85
Balance of repairs to works	10 96	10 96	10 96	10 96
Foreman	3 00	3 00	3 00	3 00
Sundries	1 50	2 00	2 50	2 00
Total daily expenses	97 69	121 03	148 46	124 09
Cost of gas per 1,000 feet	43.4	37.8	35.1	37.8
Gas used on works	45	59	73	59
Cost of gas per 1,000 feet, including cost of gas used on works.	43.6	38	35.3	38
Interest on investment—$17,500 a year	2 87	2 87	2 87	2 87
Total cost of gas manufactured, per 1,000 feet	45	39	36	39

Taking a works of an average daily make of 324,000 feet, situated under the same conditions as the case we have just considered, and we find the cost of the gas in the holder per 1,000 feet would be 39.2 cents. We allow for the use of a Ross stoker, though as a matter of fact the saving resulting from its employment in a works with so small a number of benches in use is comparatively insignificant—viz., $1.21 a day.

Taking a works of an average daily make of 100,000 feet, under similar conditions, save that the Ross stoker is dispensed with, and ar arrangement for charging such as we briefly outlined in the first part of this paper substituted in its place, we find the cost of gas in the holder per 1,000 feet to be 44.4 cents.

The economy which has been carried this far should be continued so as to include distribution. The necessity of having good mains, and these well laid, is so evident as not to call for comment. In the matter of service pipes, some managers take measures to prevent their oxidation, and this is certainly economical in the long run. The best plan seems to be to lay the pipes in V-shaped troughs which are filled with melted pitch or other impervious material, or the pipes may be coated with a mixture of red lead and oil, or tar and turpentine.

Leakage is a very important matter, and its prevention calls for the exercise of economy; for it is cheaper to keep the mains tight than lose 15 or 20 per cent. of the gas sent out. The normal rate of leakage nowadays seems to be about 10 per cent. This, for a works sending out a million feet a day would mean a loss of 100,000 feet a day, and this at 34.1 cents equals $36.90 a day, or $12,446.50 a year. Now there are many places in this country and in England where the loss is only 5 or 6 per cent.; and it seems as if 5 per cent. or lower ought to be the objective point in this matter. If the loss were 5 per cent. instead of 10 per cent., it would, in the size works we are considering, be equal to a saving of $6,223.25 a year. Allowing there are 60 miles of main in connection with such works, we would have as the amount saved per mile of pipe, if the leakage were reduced as noted, $103.72, and it would not in most cases require an expenditure of more than $45 per mile to accomplish this object. Again, this $6,223.25 affects the cost of gas delivered, to the extent of 1.8 cents per 1,000 feet.

Again, there is economy in keeping the meters in thorough repair. It is better to examine them every three years rather than once in five years. A meter at the end of three years may need repairing, but if left for five, it will possibly be beyond mending. Further, the majority of meters tested and found in error register against the company. Hence a regular inspection of the meters will be an aid in keeping down the amount of unaccounted-for gas.

Thus we have briefly reviewed a few points wherein economy may be practiced in our business—points worthy of consideration, which may hasten on that millenium for gas men when our gas is to sell for a dollar per 1,000 feet, half of which is to cover the cost of the gas delivered—on the other half our shareholders are to grow fat.

[To be continued.]

Portable Disinfector.

The principle adopted in this disinfector, by Mr. Washington Lyon, is the introduction of steam under regulated pressure, into a specially constructed apparatus, in place of dry heat, for the purpose of destroying all forms of insect life. The apparatus is made of iron, having an outer casing, with a space between, into which steam at a pressure of 25 lbs. is admitted. The articles to be disinfected are placed inside, and the door closed. Steam at a pressure of 20 lbs. is then admitted into the interior, which raises the temperature to 259° F., and disinfection commences.

[From the London "Journal of Gas Lighting."]

The Manufacture of Water Gas.

By G. Ernest Stevenson,

Secretary and Engineer of the Peterborough Gas Works.

The attention of the German gas world is just now being directed to the production of water gas. Herr Julius von Quaglio, of Wiesbaden, formerly of the Stockholm Gas Works, and Mr. George Dwight, an American, have devised an improved apparatus for producing water gas on Strong and Lowe's principle. The apparatus is simpler in construction than any hitherto in use. Our German friends are not accustomed to accept unqualified assertions respecting a new invention, without submitting the latter to rigorous scientific tests, and in this instance their faculties of minute investigation have already been brought to bear upon the phenomena exhibited, with results which we should not be disposed to regard as encouraging to any but very sanguine minds.

The principle upon which the apparatus is designed is the well-known property of carbon, when at a high temperature, to decompose steam into its elementary constituents. The process is two-fold—the steam being decomposed by the carbon, and the carbon simultaneously gasified by means of the oxygen set free from the steam. The dissociation may take place in two ways, according to the following equations :

(I.)	C	+	$2H_2O$	=	2CO	+	$2H_2$
	(2 parts)		(2 vols.)		(2 vols.)		(2 vols.)
(II.)	C	+	$2H_2O$	=	CO_2	+	$2H_2$
	(1 part)		(2 vols.)		(1 vol.)		(2 vols.)

The distinguishing feature of the two processes is the difference in the amount of heat absorbed in breaking up the steam and gasifying the carbon. If equal volumes of steam be decomposed, there will be two parts of carbon by weight converted by the first process into two volumes of carbonic oxide, whilst by the second process one part of carbon only becomes converted into one volume of carbonic acid. The heat developed in converting the one part of carbon into carbonic acid is, however, twice as great as in the production of a double volume of carbonic oxide from a double quantity of carbon ; while that absorbed in decomposing the steam remains the same in both cases. Hence, the first process requiring a greater reservoir of heat for its action than the second, the latter will, when the available heat is deficient, take precedence of the former, and the action will follow either of the two lines, according to the presence of a greater or a less store of heat in the oven or furnace.

The gas made by the first of the two chemical processes consists of combustible matter only, while that produced by the second line of action contains one-third of its volume of inert carbonic acid gas, which is useless for heating purposes. Hence the aim is to produce gas of the constitution shown by equation I., and not that due to equation II. It is therefore necessary to provide a reservoir of heat to begin with, and to replenish this store continually as it becomes exhausted.

In the action of an ordinary generator furnace this recuperation goes on simultaneously with the process of gasification, the additional heat required being provided by the extra combustion of the carbon through the oxygen of the atmosphere. In the water gas oven no atmospheric air is admitted during the period of gasification, consequently the heat required must be provided in an extraneous manner and by a separate process. The operation then becomes divided into two distinct processes, that of heating and that of gas making. In the Strong-Quaglio and Dwight apparatus the same oven serves alternately for the production of heat and of gas.

The water gas question was introduced at the meeting of the German Association of Gas and Water Engineers held at Heidelberg last year, by Herr Quaglio, who set forth its advantages in very glowing terms. Subsequently an apparatus was erected at the Frankfort gas works, and Dr. Bunte was charged with conducting a series of experiments to ascertain the economy, or otherwise, of the process. At this year's meeting of the Association, held at Frankfort, Dr. Bunte gave the results of his experiments, which appear to have been carried out with his usual thoroughness and scientific accuracy.

The "runs" with the apparatus erected at Frankfort were of 10 minutes' duration, six minutes being occupied in heating, and four minutes in gas making. The gas production during each period of gasification, occupying four minutes, was 21 cubic meters (735 cubic feet) ; and the daily production from 2400 to 2600 cubic meters (about 87,500 cubic feet). The experiments were conducted with coke from cannel coal, and the coke consumption was 81.65 kilos. for every 100 cubic meters of gas produced, this being about 50 lbs. per 1000 cubic feet. From what has been previously said, it will be understood that the production of the gas does not take place wholly in accordance with either of the methods of dissociation, but partly according to both. At the commencement of gasification, when the store of heat is greatest, the chemical action most nearly approaches the theoretical process represented by equation I.; but as the heat diminishes, it declines towards that of equation II., the proportion of carbonic acid increasing rapidly during each minute of gas production. From analyses taken at the end of each of the four minutes, the percentage of carbonic acid was found to be as follows :

	1st. Min.	2d Min.	3d. Min.	4th Min.
Analysis I....	6.0 p. ct.	9.0 p. ct.	12.2 p. ct.	14.1p. ct.
Analysis II..	5.0 "	9.5 "	— "	13.5 "

The constitution of the gas after being collected in the holder was ascertained by several analyses, of which the following is the mean result :

Carbonic acid	7.3 per cent.
Oxygen	0.7 "
Carbonic Oxide	34.5 "
Hydrogen	50.0 "
Nitrogen	7.5 "
	100.0

The oxygen and the nitrogen, as well as a portion of the carbonic acid, are due to the products of combustion, which, when the gas making commences, are carried forward to the holder, and also to the atmospheric air which accumulates in the chamber.

Besides the experiments made with coke, an attempt was made to produce illuminating gas by using coal dust and paraffine oil. The coal dust is introduced into the generator by a hopper, which, by a mechanical arrangement, delivers the contents in a continuous shower into the oven. The experiment failed on account of the large proportion of carbonic acid present in the gas, which almost entirely destroyed its illuminating power, and for the elimination of which no provision had been made.

It having been ascertained by experiment what quantity of coke was consumed in the production of a certain quantity of gas, the calculation of the amount of heat expended and lost in conducting the operation and that recovered and present in the gas produced, is a matter which does not present any difficulty. Allowing 20 per cent for ashes, clinker, etc., withdrawn from the generator, it may be taken that four pounds of pure carbon were consumed for every hundred feet of water gas manufactured. The four lbs. of carbon have a heat value of $4 \times 14{,}544 = 58{,}176$ units. On the other hand the gas produced contained 34.5 cubic feet of carbonic oxide, having a heat value of $34.5 \times 318 = 10{,}971$ units, and 50 cubic feet of hydrogen, the value of which is $50 \times 327 = 16{,}530$ units—together 27,321 heat units, or 47 per cent. of the total heat value of the carbon consumed, while 30,855 units, or 53 per cent., are used up and lost in the process of gas manufacture.

With the loss of so great a proportion of the heat contained in the original fuel, there is little likelihood of water gas becoming the fuel of the future, as Herr Quaglio and others before him have confidently predicted. It is asserted, on behalf of water gas, that its heating power is much greater than that of the carbonic oxide gas produced by the ordinary generator principle. It consists, say its advocates, entirely of combustible gas, and has not the disadvantage of the large proportion of inert nitrogen that is present in the gas produced by the generator system, and from this they assume that the combustion of water gas is productive of a much higher temperature than ordinary generator gas. If the combustion be effected by means of pure oxygen this statement is correct ; but when it takes place through the agency of atmospheric air, the argument is fallacious, inasmuch as the greater quantity of air required for the combustion of the hydrogen dilutes the products of combustion, and reduces the temperature to a lower point than that produced by ordinary generator gas. This can be easily shown in the following manner—

The water gas contains, according to Dr. Bunte's analysis, 34.5 per cent. of carbonic oxide and 50 per cent. of hydrogen, which indicate a heat value of 27,321 units in 100 feet of the gas. The 34.5 cubic feet of carbonic oxide are by combustion converted into an equal volume of carbonic acid, to which must be added 7.3 feet of the latter gas originally present, as shown by the analysis. We shall have, therefore, as one of the products, 41.8 cubic feet of carbonic acid. The 50 cubic feet of hydrogen will become a like volume of steam. Each of the two combustible gases requires half its volume of oxygen for its combustion, so that 42.25 cubic feet of oxygen must be supplied. Of this, 0.7 foot is present in the gas itself, leaving 41.55 cubic feet to be taken from the atmosphere. This necessitates the accompaniment of 156.22 cubic feet of nitrogen, and the total volume of the products is 248 cubic feet for every 100 feet of original gas consumed. The specific heat of nitrogen *per cubic foot* being 0.018, that of steam 0.024, and that of carbonic acid 0.025, the temperature may be worked out by dividing the heat development by the heat absorption per degree Fahrenheit, and by the excess of volume per cubic foot of gas, and will be found to be 2168° Fahr. In this calculation no account is taken of the probable admission of an excess of air in the process of combustion, nor of the loss of heat through radiation. The resulting temperature is therefore the highest that can be theoretically

obtained, unless the gas or the air be first pre-heated by some application of the regenerative principle.

This result may be compared with that of ordinary generator gas, such as that produced in the retort-settings of the Munich gas works, of which the constitution is, roundly, as follows :

Carbonic acid	10	parts by volume.
Carbonic oxide	20	" "
Hydrogen	10	" "
Nitrogen	60	" "

The heat developed by the combustion of such a gas would be 9630 units per 100 cubic feet, and the products resulting therefrom would consist of 30 parts of carbonic acid, 10 parts of hydrogen, and 116.4 parts of nitrogen, making a total of 156.4 cubic feet per 100 cubic feet of gas consumed. Proceeding as indicated before for water gas, the temperature will be found to be 2052° Fahr. This gas, however, delivered direct from a generator to the point of secondary combustion, would carry with it 4080 units of heat developed in its production, which would raise the temperature to 3000° Fahrenheit.

It does not transpire what is the cost of producing water gas with the Strong-Quaglio and Dwight apparatus ; but, as heretofore, one of the arguments used in its favor is the cheapness of production. A slight consideration, however, will suffice to prove that water gas cannot possibly be so economical a heating agent as generator gas. A generator gas of the constitution given above requires for its production the consumption of 0.94 lb. of carbon per 100 cubic feet. To this must be added the fuel consumed in evaporating the steam which goes to produce the proportion of hydrogen. Allowing 150 cubic feet of steam per pound of fuel as the average result of steam boilers, 0.07 lb. of fuel (which may for the purpose be taken to be pure carbon) must be added to the 0.94 lb., making in all 1.01 lbs. of carbon per 100 cubic feet of gas. The water gas is produced with an expenditure of four lbs. of carbon, without taking into consideration that required to produce the steam, of which *five times* as much is used as in the preparation of the generator gas. These facts require no comment. It is simply evident that water gas, even allowing that it possesses double the heating power of generator gas, is at least twice as costly.

If water gas be compared with coal gas as a heating agent, it will be seen that it possesses a heat value of from one-third to one-half that of the latter, and therefore, unless it can be supplied at a merely nominal cost, it will not replace coal gas in domestic heating. Indeed, it is probable that the large proportion of carbonic oxide present in the gas would prove an insurmountable obstacle to its introduction into dwelling houses for either lighting or heating purposes, as a very slight leakage of this gas in the rooms of a house would be fatal in its effects upon the inmates. Our German friends will, no doubt, speedily prove all these disadvantages to their own satisfaction, and the rosy hue of Herr Quaglio's description will give place to the more sober reality of fact.

[From the London "Journal of Gas Lighting"]

The Effect of Frost on Gas Apparatus.

SIR :—The variations in temperature from summer heat to winter frosts necessitate changes in the management of gas works corresponding with the varying temperatures at each season of the year.

During summer, gas-making operations are most easily as well as most economically conducted. This is proved by the fact that we are able to produce a given volume and quality of gas per ton of coal, by the employment of cheap cannel coals ; say, by way of comparison, at a cost of 10s. per ton delivered, which could not be done in frosty weather. This is solely brought about by the fact that the most favorable conditions for the condensation, purification, and storage of coal gas are found to be at a time when the temperature of the atmosphere is, during the months of summer, at an average of, say, 60° F.

During the frosts of winter, when the temperature is at 32°, or it may be 22°—or, as I found last winter, 13°—we are forced to employ higher class coals (to counteract the destructive effect of the frost on the gas contained in the ordinary apparatus) to an extent, I may safely say, which brings up the price of the mixture of coals by 5s. per ton. ; and if I assume that 1000 tons of coal are carbonized daily during such weather, at 5s. per ton delivered, then the effect of frost on gas apparatus costs gas undertakings carbonizing 1000 tons £250 in excess of what would have been required to produce the given volume and quality of gas during the months of summer. And this, taken at ten days of such frosty weather, would bring up to £2500 the loss chargeable as the effect of frost on gas apparatus.

In Scotland a very high standard quality of gas is still maintained, though nine-tenths of the consumers never try to use it so as to develop its highest light giving properties ; and even managers may be found encouraging their consumers' ignorance, and helping them in their wastefulness, by supplying extra good gas to make up for very bad burners and inferior fittings. They seem to vie with each other as to who can produce gas of the highest illuminating power, as if such a record bore evidence of their great ability. Such a class of coal gas is very much more seriously destroyed by frost than gas manufactured and sold elsewhere at the almost universal quality of 18-candle power, which, when properly consumed, is by far a more serviceable and cheap gas to use than, say, 28-candle power.

The remedy whereby this enormous loss—at present experienced in coal gas manufacture in frosty weather—may be greatly reduced, seems to me to be in maintaining, as near as possible, during winter the same conditions throughout the works as we find forced upon us during the summer months. I would therefore suggest that the temperature of the gas at the outlet of the condensers, and all other apparatus in the works, be maintained at not less than sixty degrees F. Existing arrangements would need to be altered a little to meet the new requirements, but this would not be a serious matter.

As to the storage of the gas, I propose that the temperature be also maintained in the holders at not less than 60° F.; and, this done—from observations I have made during the past two winters—the temperature of the street mains during frosty weather would very much help us to deliver the gas at this temperature, especially in towns of any importance. In considering the subject of protecting the holders from frost, I had thought of a covering of felt at the time I arranged for the heating of my gasholder lutes some years ago ; but any of the many non-conducting compositions, mixed with cork for lightness, could have been employed and varnished. This would only partially protect the gas in the holder from frost, and would not raise or keep up the temperature when the holder might require to be kept full or nearly so for 24 hours or more. I therefore recommend heating the contents of the holder, where such could be safely done, by a system of wrought iron hot water pipes under the crown plates of the holder.

The temperature of the gas in the holder in winter, at a time when the thermometer registered 10° of frost within 30 feet of it, I found to average 34°; and after the gas had traveled about 1½ miles it was found to have increased in temperature, by passing through underground pipes and services, to an average of 46°—having gained 12° in transit. I conclude that gas leaving the holder at 60° in winter would under these circumstances be also delivered at 60°, and do not at all believe in the condensation or liquefaction of gas in street mains in winter. Street mains and services to suit the system which this letter suggests would have three feet of cover.

The temperature of gas in summer, when tested after traveling 1½ miles, has generally been found a few degrees higher than the average temperature of the atmosphere, and in order to form a basis for further experiments I would suggest the fixing of standpipes to street mains in and around the district supplied, so as to ascertain during winter—and especially in keen frosty weather—the temperature of the gas as it is delivered.

Every employer of steam power knows how large a saving in boiler power, fuel, and labor he obtains by protecting steam boilers and pipes with a coating of non-conducting material ; and it seems to me we have omitted to take advantage of the hints we yearly receive as to how best and most cheaply to manufacture coal gas during winter by merely assimilating all conditions of working as nearly as possible to those of summer—heating and protecting our apparatus by roofs and revolving or other shutters and blinds, etc., and thereby taking advantage of the temperature of the gas during manufacture. We should thus cool down or retain the heat as desired to meet each season of the year, and the increase and decrease in volume manufactured.

TRADESTON, GLASGOW, Sept. 28, 1881. WILLIAM KEY.

Electric and Gas Competition.

The competitive test at Aberdeen of Swan's system of electric lighting against Bray's system of gas lighting appears to have been decidedly favorable to the latter, whether considered with regard to economy or illuminating efficiency. It was but too evident that by the Swan system the maintenance of a uniform light for even 15 minutes consecutively was altogether out of the question—a result which certainly will not surprise anyone acquainted with the principle of the Maxim, Swan, Edison, and Lane-Fox lamps, and the mode of generating electricity for illuminating purposes. The Swan lamps were not photometrically tested, so that when it is recollected that the Werdermann lamps, which were declared to yield 20-candle power each, proved upon actual testing to yield 8½-candle power only, it is not improbable that the Swan light may have been over-estimated in the same way—even the well trained eye in this respect being very unreliable. It is truly remarked that the task of maintaining a current of intensity over a period of 15 minutes is by no means one easy of accomplishment, and it will be also clear that the candle power of any given lamp may increase or decrease, within certain limits, with the speed at which the steam engine is driven.

Each of the Swan lamps is represented to be of 20-candle power, although

no data is given as to the motive power necessary to secure this light beyond the statement that 10 lamps require 1-horse power. There were ten bunches of seven lamps upon the current, and, according to the calculations of the Swan Company, 7-horse power ought to have been sufficient to keep the carbons in such a state of incandescence as to give 20 candles for each lamp. During the 15 minutes that the electric light held possession of the hall it was at one time more brilliant and at another time less brilliant than gas, and the power which was developed in keeping up the light was variously stated from 17-horse power (without making any allowance for the cut-off) to 8-horse. The average observations by equally competent engineers gave 147 revolutions and 40 lbs. pressure of steam, but the differences were so wide that it was considered better to take an indicator diagram, and when this was done an average of 12.7-horse power was shown.

In the trial of the gas burners invented by Mr. Bray, of Leeds, it was arranged that two of his burners, which are each represented to give a light equal to 140 candles, should illuminate the hall for 15 minutes, and that the quality of light should be calculated from the number of cubic feet consumed. About 4 o'clock in the afternoon business was commenced; all the lights connected with the various stalls were extinguished, and two of Bray's burners were allowed to do all the lighting. This they did admirably during the 15 minutes they were permitted to burn. They consumed about 47 cubic feet, and gave a light equal to 281 candles. As near as may be, this light would cost about 2d. per hour for the two burners. Taking Swan's lamp at its best, it was admittedly superior to gas, but the periods of superiority were very brief, and the gas was generally considered softer and more agreeable to the eye.

The greatest aggregate illuminating power claimed for the 14 Swan electric lights was 357 candles, obtained at a cost of 12¾-horse power per hour, against 280-candle power obtained by Brays two burners at a cost of 2d. for the two. Hence the relative cost of the two systems for an equal quantity of light for an hour would be about 2s. 1½d. by Swan's, and 2½d. by Bray's light; so that it is obvious that much greater progress must be made with electric illumination on the incandescent system before it can replace gas.—London *Mining Journal*.

The "London" Gas Engine.

The popularity of the gas engine, great as it undoubtedly is already, will, we think, be greatly extended by the introduction of the engine now being manufactured under Hutchinson's patent by the London Gas Engine Company. The design and arrangement are quite new and original. An oval shaped iron casing of considerable thickness, cast in one piece with the cylinder, conceals the piston-rod, connecting-rod, and crank from view, and while imparting to the engine great firmness and steadiness, prevents the risk of accident. Regularity in working is also attained by the employment of a specially heavy fly-wheel. All parts of the "London" engine are constructed to gauge, and are therefore interchangeable and easy of adjustment. The working parts are few in number, and are made of hardened steel so as to secure the utmost durability and smoothness of motion.

The consumption of gas is low, and can be regulated with great nicety according to the load on the engine. A two-man power engine, working at full power, consumes, on the average, three farthing's worth of gas per hour. Coal, petroleum, atmospheric, or water gas can be used equally well. A turn or two of the fly-wheel by hand will set the engine going, and a boy or a laborer can attend to it. It is, moreover, very compact and portable. The one man engine, for instance, occupies a floor space of 2 ft. 4 in. by 1 ft. 10 in., and stands 3 ft. 11 in. high, and weighs 4½ cwt.—*Ironmonger*.

Action of the Underwriters in Reference to the Use of Electric Lights.

The New York *Times*, of Oct. 25th, contains an account of the proceedings of the committee of the New York Board of Underwriters, to whom was referred the subject of devising some methods of protection against the new element of fire hazard. The following is the result arrived at—

The origin of several recent fires in this city and elsewhere being attributed to the use of electric light, the Board of Underwriters has been anxiously seeking a plan whereby the insurance interests would be in some degree protected against the new element of fire hazard. Several days ago the matter was referred to a committee consisting of W. A. Anderson, G. W. Montgomery, L. Remsen Lane, William H. Ross, A. H. Walton, J. H. Langford, and John M. Whiton. This committee made a report upon which the board has adopted a standard for electric light wires, lamps, etc., subject to future conditions. The standard is divided into five conditions, and is substantially as follows:

First.—Wires to have 50 per cent. excess of conductivity above the amount calculated as necessary for the number of lights to be supplied by the wire.

Second.—Wires to be thoroughly insulated and doubly coated with some approved material.

Third.—All wires to be securely fastened by some approved non-conducting fastening, and to be placed at least 2½ inches for incandescent lights and eight inches for arc lights, from each other, and eight inches from all other wires and from all metal or other conducting substance, and to be placed in a manner to be thoroughly and easily inspected by surveyors. When it becomes necessary to carry wires through partitions and floors they must be secured against contact with metal or other conducting substance in a manner approved by the board.

Fourth.—All arc lights must be protected by glass globes inclosed at the bottom to effectually prevent sparks or particles of the carbons from falling from the lamps, and in show windows, mills and other places where there are materials of an inflammable nature chimneys with spark arresters shall be placed at the top of the globe. Open lights are positively prohibited. The conducting frame-work of chandeliers must be insulated and covered the same as wires.

Fifth.—Where electricity is conducted into a building (from sources other than the building in which it is used) a shut-off must be placed at the point of entrance to such building, and the supply turned off when the lights are not in use.

Applications for permission to use electric lights must be accompanied by a statement of the number and kind of lamps to be used, the estimate of some known electrician of the quantity of electricity required, and a sample of the wire (at least three feet in length) to be used, with, in addition, an electrician's certificate of the carrying capacity of the wire. It must also be stated in applications where the electricity is to be generated, whether the connection will have metallic or ground circuit, and, as far as possible, give full details of the manner in which it is proposed to equip the building. The board desires all applications for the permission referred to sent to William M. Randell, Secretary of the Committee on Police and Origin of Fires.

The Waste of Fuel.

The London *Mining Journal* contains the following on this important subject—

With the facts recently made public as to the rapid exhaustion of our reserves of fuel, we are glad to find that the very important question as to the best means of preventing its waste is now receiving a good deal of attention from scientists and practical chemists. Starting from the fountain head, we find that in many districts there is a great deal of waste in mines owing to bad working and carelessness, and that to a considerable amount in comparison with the quantity of coal raised. Under the most favorable circumstances and with the best system of working there is on the average a loss of at least 10 per cent., but where the "pillar and stall" mode of working is carried on the loss sometimes amounts to as much as 40 per cent., chiefly caused by the crushing of the pillars. Large areas of coal are also left as barriers against the influx of water, owing to a want of reliable plans showing how far the coal has been worked. The remedy for much of this waste in mines, which arises from want of ordinary skill on the part of the mine managers, is a better system of working, and this to a considerable extent is now being carried out by the compulsory examination of persons seeking appointments as mine managers. In the North of England, as well as in most of our iron-making districts, there has been a marked decrease in the quantity of fuel required for making pig iron, and this is still going on. At one time it took four tons of coal to make one ton of pig, but in the Cleveland district, by increasing the capacity of the furnaces, using highly heated air, and by the application of the furnace gases to the steam boilers and hot blast stoves, the iron makers have reduced the quantity for making one ton of pig to something less than two tons of coal, and a still further diminution in the same direction may be looked forward to. In the North of England nearly eight millions tons of coal are annually put into the coke ovens, producing close upon five millions tons of coke, by which at least three millions tons of inflammable gas are evolved in the process, but here there is a vast loss in the production of the heat, for only about one-third goes to the making of the coke, the other portion escaping in the shape of flame from the ovens, sending deadly vapors in all directions, and destroying vegetation, besides causing no little injury to the health of the inhabitants. Of late efforts have been made to utilise this waste, so that there is now no difficulty in obtaining from it the necessary heat for the boilers working at the collieries connected with the ovens. Economy in the consumption of fuel for steam engines has been receiving special attention from our ablest engineers, and that with considerable success, and it has been found that to obtain a high measure of economy it is not sufficient that steam of a good pressure should be worked expansively. The steam should be superheated to a moderate extent, and the cylinders in which the expansion takes place should be steam-jacketed. In good compound engines the consumption of fuel

per indicated horse power per hour is on an average about two pounds, and sometimes even less. The cost of such engines is less than for the old type which employs a less measure of expansion, and consumes more than twice the quantity of fuel, and a saving in that respect means a saving of steam and of boilers as well. Another advantage is that while slow engines require a large amount of steam room, which implies large boilers, in swift-moving engines a very small amount of steam room is required. Considerable improvements have been made in the economising of fuel in engines of all kinds, and these include better workmanship and materials in construction, the employment of a high pressure and temperature of steam used expansively, and the introduction of a higher speed of piston.

The waste that takes place in the burning of coal for household purposes is something that is really immense, and as yet but little has been done towards materially lessening it, although we are dependent upon it, not only for giving us heat and light, but for keeping all our great industries going. If we take London alone we find that within it nearly 9,000,000 tons of coal are annually consumed, or at least burned, and whilst it gives what we consider necessary for our requirements, it also gives us what is most injurious to our health. We are told that the fires in the Metropolis send out into the atmosphere not less than 400,000 tons of smoke and soot, 120,000 tons of sulphur, and an immense quantity of the most unwholesome gases of considerable thermal value. The same thing goes on in towns and villages, not only at home, but throughout a considerable portion of the world. The material comes down upon us whilst walking, in the dirtiest shapes, enters our houses, and sensibly affects our health.

This vast waste of valuable material has been an admitted evil for years, during which various means for utilising and rendering it harmless have been suggested. The difficulty has been found in converting the coal into gas in the grate and mixing it with the air. It is indeed a matter for serious consideration that the coal we burn in our grates does not give more than four per cent. of the heating power it contains, the remainder being all wasted. It has been proposed to burn anthracite in the Metropolis, which does not give off much, if any, smoke, and gives a much larger amount of heat than any other description of coal; but this we do not think would answer the expectations of those who propose it, and would be adopted in comparatively few instances. Those who have made the combustion of fuel a specialty and devoted a good deal of attention to it, now are agreed that the best system that is capable of being carried out is the gasification of coal at large works, and in that state distributed to consumers by mains. This appears a most feasible method for extracting the heating properties from the raw material, and sending it in the gaseous state for all household purposes.

It would certainly have the effect of giving the residents in the Metropolis and our large towns a much clearer and healthier atmosphere that would be enjoyable even to invalids, and would tend greatly to diminish the rates of mortality. With the improvements that may still be looked forward to in blast furnaces, engines, and boilers, we may expect to have a considerably less quantity of coal consumed for a given quantity of work than is the case at present.

The adoption of gas for household and even for manufacturing purposes, will lead to a less demand being made upon our stores of coal, and so prolonging the time of their exhaustion to a period far beyond what would be the case were the present rate of consumption continued indefinitely.

Action of the Franklin Institute Concerning the Randolph Mills Disaster.

At a meeting of the Franklin Institute, held on Wednesday evening, Oct. 18th, at the Hall of the Institute, Philadelphia, Pa., a committee was appointed by President W. P. Tatham, to investigate the causes which led to the destruction of the Randolph Mills by fire. Mr. W. V. McKean offered the resolution which led to the appointment of the comittee, and it was as follows:

Resolved, That the President be authorized to appoint a committee to investigate and report upon dangers incident to electric lighting, if any, and the means of overcoming them.

In pursuance of the mandate of the resolution the following gentlemen were appointed—

Dr. R. E. Rogers; Dr. C. M. Cresson; David Brooks; Alex. E. Outerbridge, Jr.; W. W. Griscom; E. Alex. Scott; Prof. E. J. Houston.

The composition of the committee will serve as a guarantee that the subject will receive the thorough investigation that its importance deserves, and their report, and its conclusions will be looked forward to with no inconsiderable degree of interest.

Rendering Leather Waterproof.—Melt three ozs. lard and add one oz. powdered resin. This mixture remains soft at ordinary temperatures, and is an excellent application for leather.

Dangers of Electric Light Wires.

The question of the safety of the electric light wires, as at present arranged, is beginning to excite the attention of the Fire Commissioners. Yesterday one of the wires came in contact with a fire telegraph wire downtown; the powerful current from the former flashed into the alarm-box in William street, near New Chambers street, and destroyed it. On Monday the woodwork over the entrance of the Germania Theater, at Broadway and Thirteenth street, was set on fire by the accidental breaking of the material insulating the wire that feeds the electric lamps over the door. The unprotected wire came in contact with some lead ornaments, which were quickly melted, and the woodwork was set on fire. The Fire Commissioners fear that when the wires, which are now new, become old and worn, much trouble will result.

There is another difficulty with the electric light wires. If it should be necessary for the firemen to cut them from the roof of a burning house, they would run the risk of losing their lives in the work. It is necessary to cut the wires with a wooden handled instrument to protect the man; but should the wood happen to be wet, as it is very apt to be at a fire, it would become a conductor, and the strong electric current might kill a man, just as a flash of lightning would. The utmost care has heretofore been exercised, but serious harm may result at any moment. The Fire Commissioners have the matter seriously under discussion.—New York *Tribune*, Oct. 26.

Fire Alarms Crippled by Electric Light Wires.—Three of the fire alarm telegraphic circuits were rendered useless last Tuesday, the magnets in three of the boxes were destroyed and the relay magnets at Fire Headquarters were burned out by the accidental contact of certain wires of the Fire Department with a wire of the Brush electric light company. The Fire Commissioners met yesterday, and recognizing the fact that such occurrences might entail very disastrous results, adopted a resolution requesting the department attorney to report as to the course to be pursued to prevent a repetition of such accidents and to secure payment for the damage already done.—New York *World*, Oct 29.

New Gas Company.

On September 28th the articles of incorporation of a new gas light company were filed in the office of the Superior Court, San Francisco, Cal. The new company has been organized under the general laws which govern manufacturing concerns in that State, and the field of operation of the new venture will be in the city of San Francisco.

The amount of capital stock has been fixed at two and a-half millions of dollars, divided into 25,000 shares of the par value of $100 each. The incorporators are Fred. F. Low, Walter M. Castle, Egbert Judson, Henry M. Martin and Eugene E. Dewey. It would seem that San Francisco was quite liberally supplied now with companies for the manufacture of gas.

Civilization and Health.

Is the human race deteriorating, physically? In other words, is civilization a shortener of life, or otherwise? Although much may be said for the haleness and heartiness of our grandfathers, and much against the pale, slim city-bred dyspeptic, yet we cannot but come to the conclusion that the race is not in so sorry a plight as some people would judge.

Among savages life is short, and it is the exception for a man to attain to 50 years, while long before that his powers are decayed. Then, too, in the records of English courts, from the 13th to the 16th century, Sir Thomas Hardy found no instance of a man who had survived his 80th year, and the age of 70 was rarely reached, and was regarded as extreme.

The advance in medical knowledge, the spread of education and sanitary improvements have, taken together, had a great effect in adding to the average of men's lives. It is true we see certain signs of decay, notably in the teeth of the present generation; but these are the result of local causes which it may be hoped will disappear in course of time. Railroads and steamships do much, indirectly, to benefit the race constitutionally, in bringing together to this country hardy representatives of other races. The intermixture of blood which is the result cannot but exert a highly beneficial result on this nation.—*Herald of Health.*

A Steel Tube for the English Channel.

A grand scheme is said to be in contemplation for crossing the English Channel. A line of steel tubes, sixteen feet in diameter, is proposed to be sunk and firmly anchored at a sufficient depth below the surface to be out of the way of navigation. It is to be ballasted to overcome the buoyant effect and secured to sunken caissons by chains.—*Sci. Am.*

THE AMERICAN GAS-LIGHT JOURNAL

A. M. CALLENDER & CO.,
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Manager—C. E. SANDERSON.

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WEDNESDAY, NOVEMBER 2, 1881.

Official Report of Examinations of Gas for three Weeks ending Oct. 29, 1881, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

1881. Oct	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
		†	*	†	‡	*	†
10	Between	26.73	19.26	25.42	22.65	18.75	28.85
11		24.97	19.24	26.21	23.25	18.66	29.86
12	9.30 A.M.	25.19	19.52	24.30	22.69	19.01	29.42
13	and	24.21	18.86	23.77	21.56	19.42	28.08
14	1 P. M.	26.91	20.05	24.79	22.43	19.47	30.31
15		26.71	18.45	25.69	22.72	19.21	30.36
	Average	25.78	19.23	25.03	22.55	19.08	29.48
17		21.43	20.73	26.25	24.42	20.31	29.00
18		26.23	21.01	26.01	24.34	19.73	29.43
19		24.91	21.15	25.73	24.96	19.80	29.82
20		25.18	20.08	26.56	23.50	19.61	29.46
21		24.59	20.78	26.48	24.96	20.42	30.80
22		24.36	20.12	26.23	24.50	19.99	30.34
	Average	24.45	20.64	26.21	24.44	19.97	29.81
24		25.60	20.82	27.38	23.92	20.19	30.07
25		27.05	20.65	27.38	24.20	19.92	31.42
26		25.92	20.10	24.88	23.10	19.79	30.78
27		26.40	21.19	26.82	23.24	19.06	31.15
28		24.08	20.68	25.01	23.11	19.76	30.55
29		24.07	20.05	24.74	23.27	19.57	30.34
	Average	25.52	20.58	26.03	23.49	19.71	30.72

* Five foot lava tip with check.
† Bray's slit union, No. 7.
‡ Bray's slit union, No. 6.

E. G. LOVE, Gas Examiner.

Gas Explosion in Pottsville, Pa.

An explosion occurred in the machine which makes the gas at the Pottsville works Oct. 21st, which, while it injured no one, resulted seriously in the town. It happened that the company had but 25,000 feet of gas on hand at the time of the explosion, which not only completely wrecked the one set of machines in use, but also broke the connections of the other set and threw them out of service. The repairs will take a day or two, and as the daily consumption is from 40,000 to 50,000 feet, the town will have to go back to tal low dips in the meantime. The cause of the explosion has not been discovered yet.—*Exchange.*

Russian Coal Mines.

Most of the South Russian coal supply comes from Donetz district, and the total amount obtained this year will be about 1,000,000 tons of bituminous and 600,000 tons of anthracite coal. The latter was discovered in the north of Russia as recently as 1875, on the coast of lake Onega. This fuel is made up into briquettes of two classes, one consisting of 7 per cent. bitumen, 25 per cent. coal, 68 per cent. anthracite; the second of almost equal parts of peat and anthracite, with a small amount of bitumen. The price of the former quality in St. Petersburg varies from 17s. to 22s. per ton. The anthracite deposit lies 36 yards below the surface, and is 11 ft. in thickness; below this there are three other seams of almost the same depth. The turn-out from these mines is equal to 30,000 tons a year.—Newcastle *Chron.*

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
34 PINE STREET, NEW YORK CITY.

NOVEMBER 2, 1881.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid.	Asked
Gas Co.'s of N. Y. City.				
Central	$466,000	50	60	65
Harlem	1,800,000	50	90	95
" Bonds	170,000			103
Manhattan	4,000,000	50	210	215
Metropolitan	2,500,000	100	152	155
" Bonds	658,000	..	107	110
Mutual	5,000,000	100	72	75
" Bonds, go'd.	900,000	1000	100	104
Municipal	1,500,000	100	175	178
" Bonds	750,000		106	110
New York	4,000,000	100	103	105x
Northern	270 000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	128	132
Citizens	1,200,000	20	50	53
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal	1,500,000	100	68	72
Peoples	1,000,000	10	35	40
" Bonds	290,000	.	101	104
" "	250,000	...	70	75
Metropolitan	1,000,000	100	65	70
Nassau	1,000,000	25	65	70
" Ctfs.	700,000	1000	95	100
Williamsburgh	1,000,000	50	65	70
" Bonds	1,000,000	...	98	103
Richmond Co., S. I.	300,000	50	70	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	72	76
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			43	44
Bonds			77	—
East Boston, Mass		25	114	120
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	755,000	40	117½	
Jersey City	750,000	20	155	160
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo	1,200,000	100	108	110
Montreal, Canada	2,000,000	100	153	154
New Haven, Conn		25	132	—
Oakland, Cal			32	33
Peoples, Jersey City		...	95	100
" " Bds.				5
Pittsfield, Mass			120	130
Rochester, N. Y.		50	70	80
" Citizens		100	30	35
Wilmington, Del.		50	174	...
Yonkers		50	30	32
St. Louis Missouri	600,000	50	250	254
San Francisco Gas-Co., S. Fr'isco Cal.			68	69
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C.	1,500,000	20	213	215
" Scrip	375,000	15	230	233

The following stocks were so'd at auction: 1 share Citizens, of Brooklyn, at 50; 60 shares Metropolitan, Brooklyn, at 68; 1 share Peoples, ditto, at 37; $6000 Citizens sinking fund bds., due 1899, at 105½; $3000 Peoples first mtge., due 1897, at 106½; $2200 Peoples mtge. bds., due 1900, at 91; 5 shares New York, ex. div., at 104.

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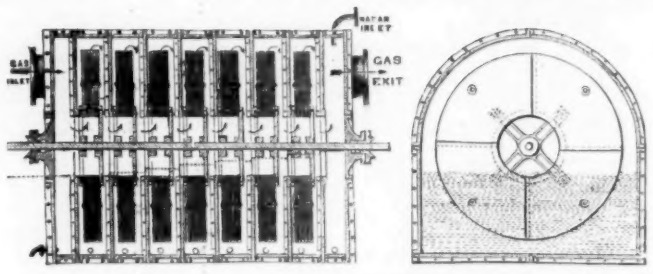

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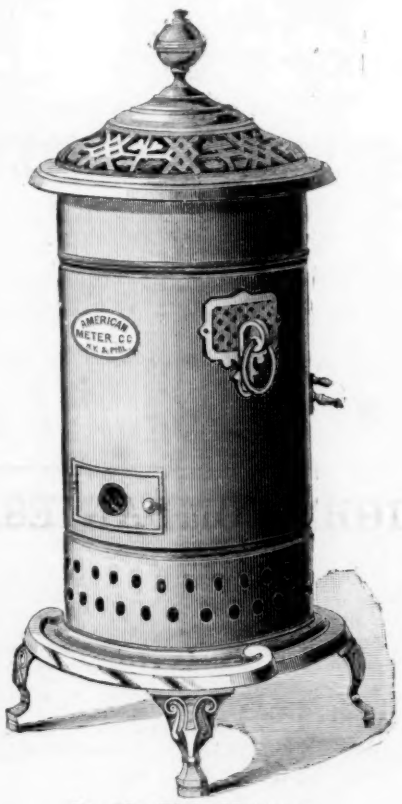

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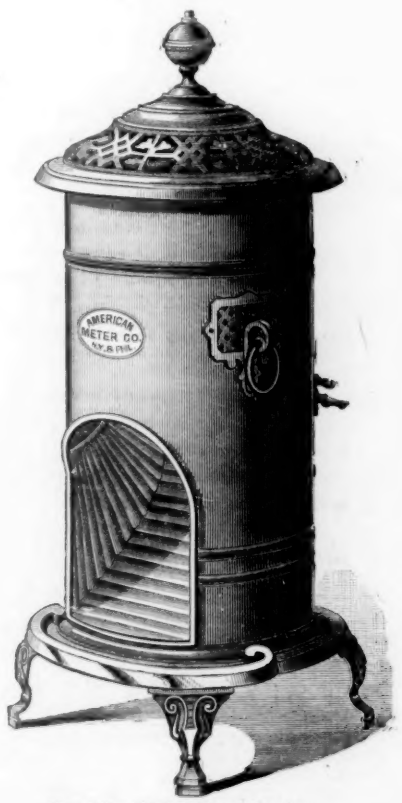

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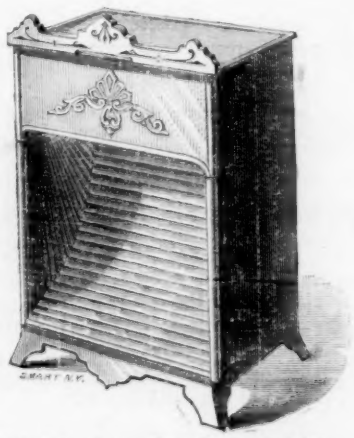

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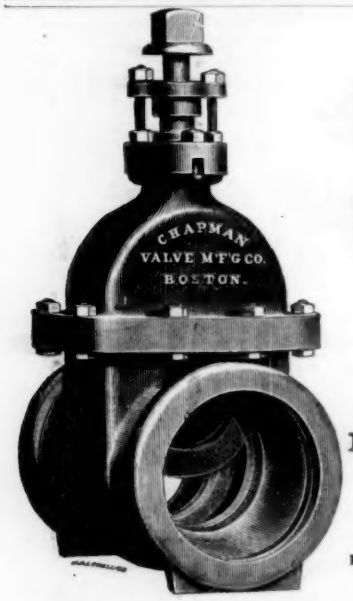

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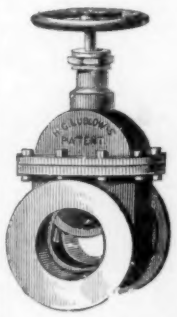

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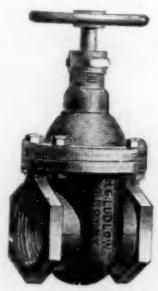

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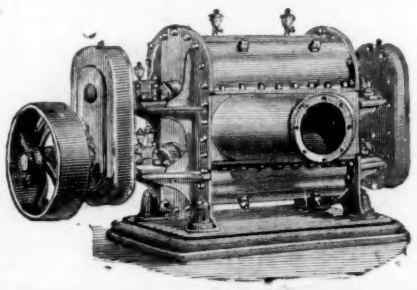

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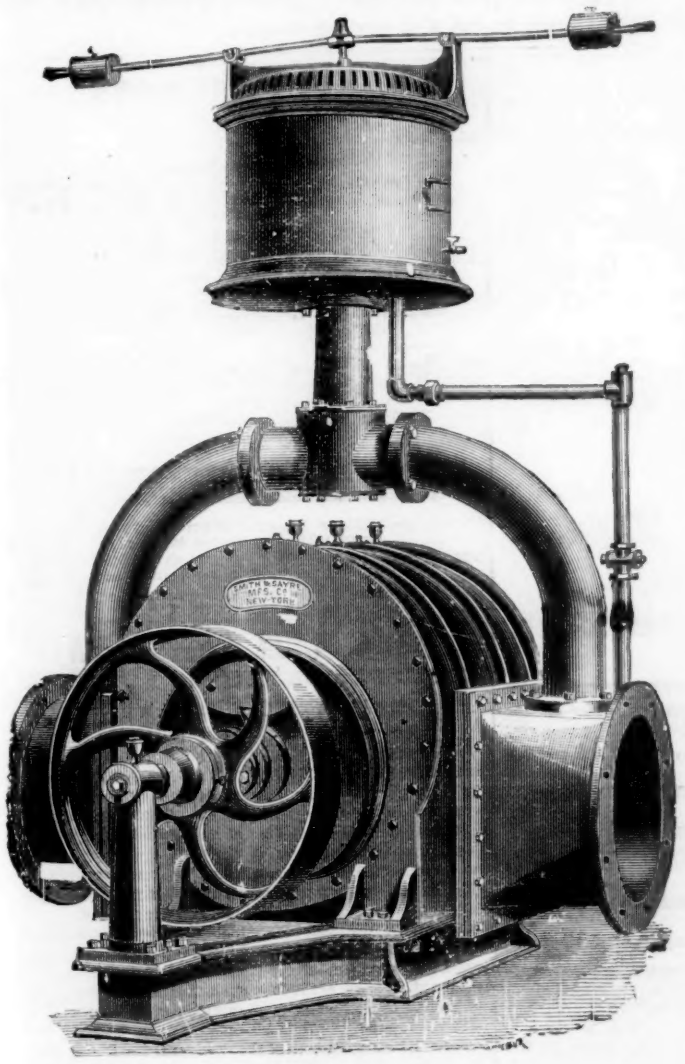

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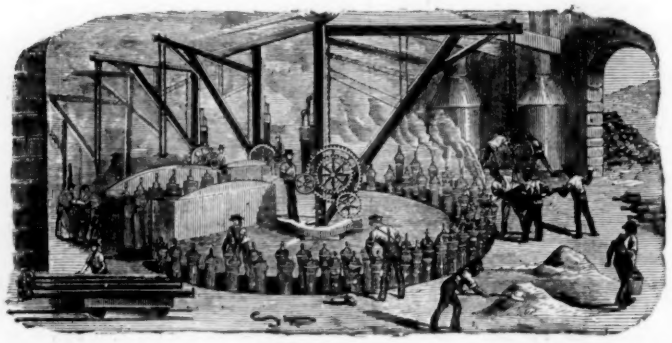

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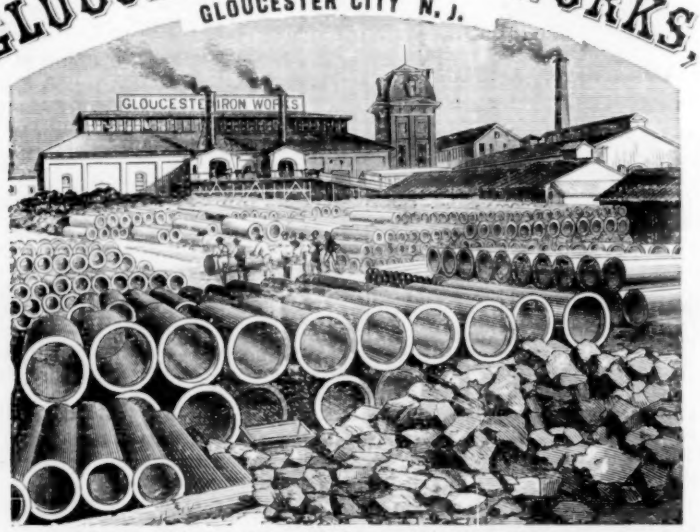

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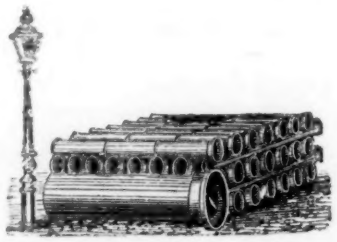

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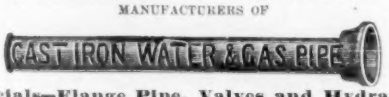

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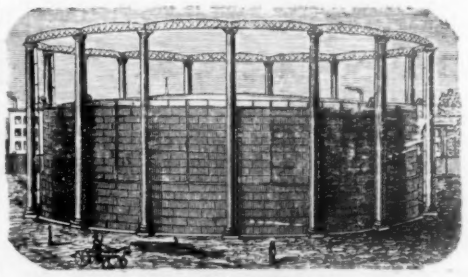

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Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

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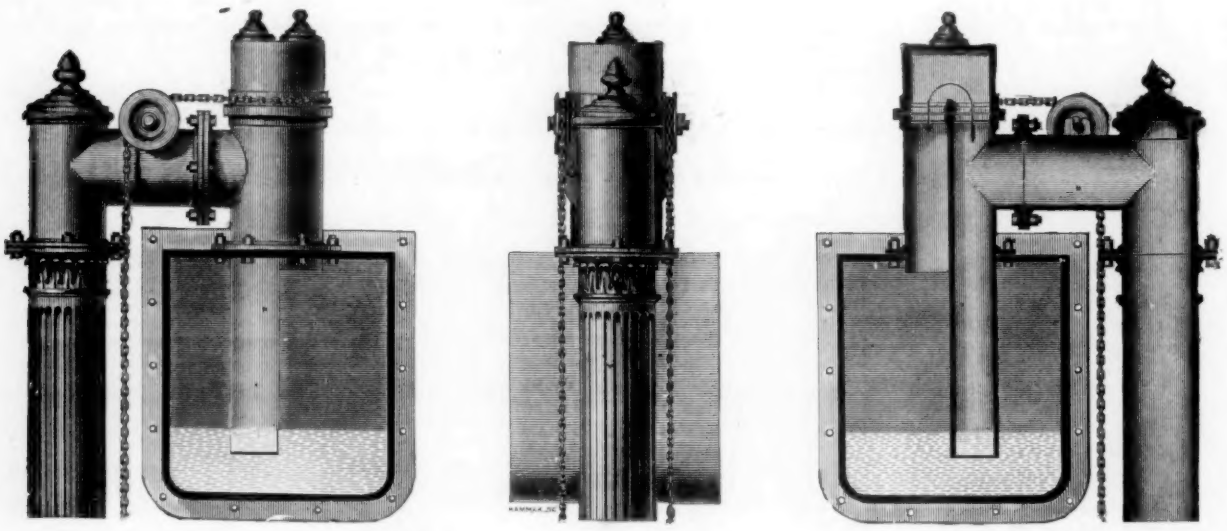

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